

ATTACHMENT B

IN THE UNITED STATES DISTRICT COURT
FOR THE SOUTHERN DISTRICT OF MISSISSIPPI
(Northern Division)

UNITED STATES OF AMERICA,)
)
 Plaintiff,)
)
 v.)
)
 THE CITY OF JACKSON, MISSISSIPPI,)
)
 Defendant.)
 _____)

Case No. 3:22-cv-00686-HTW-LGI

**DECLARATION OF BRIAN
SMITH IN SUPPORT OF THE
UNITED STATES' MOTION TO
ENTER INTERIM STIPULATED
ORDER**

I, Brian Smith, pursuant to 28 U.S.C. § 1746, declare as follows:

I. PROFESSIONAL BACKGROUND

1. I have worked as an Environmental Engineer or Supervisory Environmental Engineer in EPA Safe Drinking Water Act programs since October 2002. During this time, I have been responsible for inspections, providing technical, managerial and financial training, assessing compliance and providing technical assistance for drinking water systems. I have a B.S in Chemical Engineering from Tulane University, was a registered Professional Civil Engineer in the State of California until December 2021, and held a Class III Water Operators Certification from the State of Georgia until June 2021. From 2002-2015, I was an EPA staff engineer responsible for directly implementing the National Primary Drinking Water Regulations in Indian country, as well as performing federal oversight of delegated state drinking water programs. In this capacity, I worked directly with water system operators, utility managers and state drinking water programs to provide technical assistance and training on regulatory

compliance, to conduct onsite reviews of water system infrastructure and operations and to assess a public water system's technical, managerial, and financial capacity to operate in compliance with drinking water regulations. Beginning in 2018 and continuing to the present, I have been the Chief of the Safe Drinking Water Branch, and responsible for managing the Safe Drinking Water Act (SDWA) programs in EPA, Region 4 Water Division, including the oversight of delegated state Public Water System Supervision Programs, coordination of technical assistance efforts with public water systems, and management of the Region's Water Emergency Response Team.

2. As the Chief of the Safe Drinking Water Branch, I have been closely involved in efforts to assist the City of Jackson ("the City") with technical and compliance issues over the last several years. Since the crisis that occurred in August-September 2022, I have led EPA's involvement in the Presidentially-declared emergency for the City of Jackson. I have represented EPA in the Unified Command, which along with EPA, includes the City, the Federal Emergency Management Agency, the Mississippi Emergency Management Agency (MEMA), and the Mississippi State Department of Health (MSDH). I was the first EPA representative onsite to stand up the response and have deployed for four field rotations in Jackson leading the EPA water response team. I have continuously led EPA's participation in the response since August 31, 2022, with a total of 33 days onsite. I have personal knowledge of the surface water and groundwater systems that make up the City's drinking water system (collectively, "the System"), its current challenges, and the facts described below.

II. HISTORY OF INVOLVEMENT WITH JACKSON'S DRINKING WATER SYSTEM

3. In early 2016, I was first made aware of issues with the System and began providing technical and compliance assistance to the MSDH's drinking water oversight program regarding these issues.

4. Since 2016, the City has been in violation of the SDWA for not implementing Optimized Corrosion Control Treatment, for elevated levels of disinfection byproducts, for failure to address water system deficiencies identified during state inspections and for turbidity exceedances in surface water treatment.

5. In February 2020, EPA conducted a compliance inspection of the City's water system, which revealed significant concerns about the System. As a result of the inspection's findings, I coordinated with EPA Region 4's Enforcement and Compliance Assurance Division (ECAD) on assistance priorities at the City and subsequent enforcement actions, including the 2020 SDWA 1431 Imminent and Substantial Endangerment Order ("Emergency Order") and the 2021 SDWA 1414 Administrative Order on Consent ("Consent Order").

6. The 2021 Consent Order included a Comprehensive Equipment Repair Plan (CERP) to address the numerous deficiencies impacting the ability of the City to produce a constant supply of safe water. The CERP required the City to (1) increase staffing of operators and maintenance technicians; (2) repair water and chemical metering equipment so chemical dosing could be based on flow rates of water through the plant, instead of the resource intensive manual operation of pumping and chemical feed rates; (3) assess and repair/replace the inoperable residual solids (or sludge) removal system from the sedimentation basins, which requires shut-down and manual cleaning of large concrete basins that are critical to effectively remove contaminants and maintain water production; (4) complete a corrosion control study; (5) repair inoperable filters

and membrane treatment systems needed to remove contaminants from water and increase the amount of water that can be produced; (6) repair disinfectant systems including UV lights and chlorination systems to make sure bacteria or viruses in raw water are inactivated and the water delivered to the distribution system is safe to drink; and (7) build an enclosure for the membrane treatment plant that was inoperable during a 2021 winter freeze because of exposure to freezing conditions, as the covering included in initial design was removed from the plan to save cost for the City. The impact of the 2021 plant shut down due to the freeze was nearly 100,000 residents without water service for up to three weeks.

7. Many of the requirements in the CERP were needed because of the City's insufficient resources dedicated to preventative maintenance of equipment and low levels of staffing for proper repairs and operation of treatment infrastructure. EPA held bi-weekly calls with the City to monitor progress with the CERP, most of which I, and/or someone who reported to me, participated in.

8. The Region 4 Water Division also worked with MSDH to ensure funding from EPA's Drinking Water State Revolving Loan Fund was available for the City to address critical repairs. In the 2021 funding cycle, a \$27 million loan was awarded to the City.

9. In March 2022, the Safe Drinking Water Branch coordinated an evaluation of the City's distribution system operations. We provided a summary of findings to the City in July 2022 ("2022 Assessment"). A true and correct copy of the 2022 Assessment is attached as Exhibit A to this declaration.

10. The 2022 Assessment identified several issues with the System's operation, including but not limited to: (1) the fact that around 50% of the System's water is lost to leaks or otherwise unaccounted for in billing, (2) the frequent loss of pressure due to line breaks requiring the City

to issue over 300 precautionary boil water notices over the past two years, and (3) the lack of any plan for routine flushing of the distribution system, exercising of valves, real-time monitoring of distribution system pressure, or managing water levels in storage tanks. The summary of findings included a prioritized list of recommendations to address these and other issues.

11. The City has also experienced several surface water system pressure losses related to failures of the O.B. Curtis Water Treatment Plant including: a February 2021 outage caused by a prolonged deep freeze that impacted portions of the treatment system that did not have weather protection; an electrical fire in April 2021 that damaged pump controls; a treatment chemical concentration error that caused treatment failure in November 2021; a broken water line that flooded portions of the treatment plant chemical building in April 2022; and the August 30, 2022, Central Mississippi flooding event described in Section II of this declaration. During times of pressure loss, including those described above, water service is not available throughout most of the City and firefighters cannot fight fires, schools and business have to close, and residents cannot drink the water, flush toilets, wash clothes or bathe.

12. In other recent instances, the City has narrowly avoided a loss of water service. For instance, June 2022 email correspondence from the MSDH communicated that the City proposed to issue a Boil Water Advisory because the production of the water treatment plants could not meet demand, and the City considered a temporary stop of service in order to “catch up” on treatment of water. EPA and MSDH both encouraged the City to issue a conservation order in the City and to maintain water service as an alternative to stopping service, which it did. In July 2022, the J.H. Fewell Water Treatment Plant (WTP) was at risk of having to shut down due to the Public Works Department not having the financial capacity to purchase necessary treatment chemicals. The issue was elevated to the Mississippi State Health Officer who engaged directly

with the Mayor to ensure an adequate supply of treatment chemicals was immediately purchased and delivered.

III. THE AUGUST 30TH FLOOD EVENT AND EMERGENCY RESPONSE

13. During the last week of August 2022, heavy rain caused the Pearl River to flood areas around Jackson, MS. This flooding event disrupted the City's ability to produce an adequate quality and quantity of water leading to a pressure loss in the City's distribution system. While the floodwater never reached the property of the water treatment plants, it did cause debris to partially block the J.H. Fewell water intake in the Pearl River and the O.B Curtis water intake in the Ross Barnett Reservoir. The floodwater also had a lower pH, which the City would have been able to treat if the water treatment plants had been fully operational. However, deferred maintenance of treatment equipment and a lack of necessary treatment chemicals resulted in an inability for the City to adequately treat the water and the need to shut down filtration equipment. The reduction in water being produced in the water treatment plants caused low pressure in the distribution system and eventual loss of water service to most City residents.

14. The water outage lasted for approximately one week during which time affected residents could not wash, flush toilets, or bathe, and the City had inadequate fire suppression capabilities. Many schools and businesses had to close due to safety and public health concerns associated with lack of water service. During this time, MEMA began distribution of bottled water for drinking and cooking and non-potable water for residents to use to flush toilets, to augment the City's bottled water distribution effort.

15. On August 29 and 30, 2022, the City and Hinds County issued Local Proclamations of Emergency, the MSDH issued a Public Health Emergency, and the Governor of Mississippi declared a State of Emergency for the City. Unified Command was established at the O.B. Curtis

WTP by the State of Mississippi (“the State”), including MSDH and MEMA, and the City. On August 30, 2022, the President declared a Federal Emergency under the Stafford Act, and FEMA and EPA joined Unified Command. Unified Command is established to streamline communication and coordination of response operations among multiple organizations in an emergency. Each entity had its own authorities, such as MSDH and EPA’s regulatory oversight authorities for drinking water systems, as well as resources available in an emergency situation. Unified Command sets a common set of priorities for response coordination and develops action plans to direct available resources to identified needs.

16. The immediate priorities of the emergency response were to provide alternative sources of potable and non-potable water for drinking, cooking, and hygiene, and to restore System pressure to meet immediate life safety needs, such as firefighting, and address sanitary issues, such as washing and flushing toilets. As part of the emergency response, EPA coordinated with City and State partners to temporarily bring in water professionals through mutual aid from other utilities in Mississippi and from other states. Water operators, maintenance technicians, electricians and instrument technicians augmented City staff to make emergency repairs and assist in restoring water service. Mutual aid utility response resources were sourced through the Mississippi Rural Water Emergency Compact (for intrastate mutual aid) and the Emergency Management Assistance Compact (EMAC), for interstate mutual aid, and funded by MEMA through October 18, 2022.

17. Prior to the federal, State, and local emergency declarations, the City’s surface water system had already been on a State-imposed boil water order due to treatment failures associated with exceeding allowable levels of turbidity after filtration at the O.B. Curtis WTP. Turbidity is used to measure the effectiveness of filtration in removing potentially harmful organisms such as

bacteria. If turbidity standards are exceeded, water systems are required to notify the public of the violation and issue a boil water notice. No new boil water notice was needed after the pressure loss from the flooding event, because the City was already on the existing advisory to boil water—since July 29, 2022—before drinking, making ice, brushing teeth, washing dishes, preparing baby formula or medicine, or food preparation.

18. Once water pressure was restored on September 6, 2022, the focus of the response was to restore water quality. EPA, in partnership with the City and MSDH, conducted monitoring of chemical treatment processing in the water plants to inform operators on process control improvements. EPA also conducted monitoring of water quality in the distribution system to identify areas of poor water quality and to assess treatment and distribution system flushing needs. Once water treatment was stabilized, the City conducted two rounds of bacteria monitoring and confirmed no detections of bacteria at 140 designated locations throughout the City. Consequently, the boil water advisory was lifted on September 15, 2022.

19. The next phase of the response was to increase the capacity of both the O.B. Curtis and J.H. Fewell WTPs to make more water so that, on a routine basis, equipment could be taken out of service for preventative maintenance without jeopardizing the delivery of an adequate supply of safe water. EPA also provided support to Unified Command's efforts to solicit a full-service operation and maintenance contractor for the City, to lead tours in support of that solicitation, and to review proposals to assess qualifications. Addressing short and long-term operation and maintenance staffing remains a top priority for sustained water service.

IV. CURRENT STATE OF THE DRINKING WATER SYSTEM IN CITY OF JACKSON

20. In the wake of the emergency response, the System remains in a tenuous state of operational vulnerability due to the lack of funding and personnel for operation and maintenance

of the System and due to challenges with City procurement of needed supplies, equipment and services. On October 20, 2022, the City issued a Request for Proposals (RFP) for a 12-month emergency procurement contract for staffing, operations, maintenance, and management of the System. However, as of November 28, 2022, the City has not addressed critical staffing needs for sustained operations or successfully contracted with an outside Operation and Maintenance entity. The City has entered into a temporary 10-week contract for four operators, which began on November 14, 2022.

21. In addition, many of the resources that have been used to address the crisis arising from the late August flooding event are temporary measures associated with the declared emergencies. The Mississippi State of Emergency ended on November 22, 2022, which marked the end of MEMA's involvement in the Unified Command and its authority to purchase maintenance or repair equipment and specialized services. MEMA's maintenance contract with Hemphill was transferred to the MSDH. MSDH will manage the Hemphill maintenance contract until \$250k has been expended or until January 9, 2022, whichever comes first. The contract with Hemphill is for general maintenance services but does not include operations, or the purchasing of needed equipment or procuring specialized repair services. The City has primarily relied on MEMA for emergency procurement during the State of Emergency. The Federal Emergency Declaration ended on November 28, 2022, and the MSDH emergency declaration is scheduled to end on December 29, 2022. After these dates, the emergency onsite support from State and federal partners will cease.

22. Federal assistance under the Stafford Act was available only for the limited purpose of addressing the flooding event, and not for the pre-existing conditions associated with deferred maintenance of the dilapidated distribution system. With a lack of funding to address the pre-

existing problems, little progress has been made on repairing leaks in the water distribution system, which contribute to the loss of roughly 50% of the water produced by the System. Therefore, even though the emergency repairs have increased production capacity at the water plants, about half of that increased production will be lost to leaks. The increased production capacity will also be lost if adequate maintenance is not routinely performed. Based on recommended cleaning schedules of the membranes at the O.B. Curtis WTP, reduced capacity will likely occur within one month of deferred maintenance.

23. In addition, as demonstrated by several issues that have arisen over the last several years, the City of Jackson currently lacks the managerial capacity for day-to-day operational and long-term planning needs for a water system serving a city the size of Jackson. Since my first engagement with the City in 2016, the position of the Public Works Director has been filled by six different individuals, and positions for maintenance and water treatment plant supervisors have primarily remained vacant.

24. The City of Jackson stands out among large water systems across the nation as having an unusually high number of water outages, line breaks and treatment violations. Staffing levels remain low, leading to the inadequate maintenance of water treatment and distribution system components causing the problems that preceded and greatly exacerbated the emergency situation.

25. Many critical repairs required by the CERP and recommended in the 2022 summary of findings remain unresolved, such as the automation of treatment chemical dosing controls, replacement of the sludge removal system in the sedimentation basins, restored capability to add treatment chemicals and monitor water quality at the raw water intake, and establishment of optimized corrosion control treatment. The recommendations to install pressure monitoring in

the distribution system, to identify the location and positioning of valves, and to develop a System-wide flushing protocol remain unaddressed.

26. The City continues to issue boil water notices associated with localized pressure loss in the distribution system. Based upon information that has been furnished to me in my official capacity, the City issued 303 boil water notices between May 11, 2020 and September 15, 2022. Since September 15, 2022, the City has issued an additional 42 boil water notices. During my time in Jackson, I have witnessed times when the water treatment plants cannot produce enough water to keep water in all distribution storage tanks due to pump failures, lack of maintenance to keep water treatment equipment operational, and water loss through leaks in the distribution system. As recently as November 18, 2022, a water outage was averted because of response support from the State. An electrical supply issue caused the O.B. Curtis WTP to stop operating and damaged two power supplies for the Membrane system controls. The City has one spare power supply but could not procure a second. MEMA was asked to make the approximately \$1000 purchase so the power supply could be reinstalled on the same day. Unified Command estimates that a System-wide pressure loss would have occurred within 2-3 hours after the second power supply was installed. The City's process for timely approval of purchases for emergency repairs remains a vulnerability.

27. Based on my experience at the System and through conversations I have had with water plant staff and other water professionals supporting the response, I believe there remains a real threat of System-wide water outage, continued issuance of boil water notices, and public health risks that the City does not have the staffing and managerial capacity to mitigate at this time. I also believe there is a high risk of future regulatory treatment violations without the repairs to the chemical treatment systems and filtration systems.

28. As of November 21, 2022, there are no plant supervisors to direct operators and maintenance staff or to manage the overall needs and resources of the facilities. Unified Command has helped to temporarily fill this management vacuum during the emergency operation.

29. Due to what I have witnessed regarding the lack of ability of the City to procure supplies and equipment for repairs, the lack of City's ability to secure contract staff for plant maintenance, and the fragile status of the water treatment plants and distribution system, I sent a request to MEMA, on behalf of EPA, to extend the state of emergency on November 14, 2022.

30. In the short term, the City does not have the capacity to maintain and operate the System without risking a water plant shut down or contamination that could cause an imminent and unacceptable risk to public health.

31. There is currently no one in the Public Works Department with utility management experience greater than three months, and this is not an easy system to manage in light of the system's complex design and maintenance needs. In my professional opinion, over the past five years, the System's capacity for sustainable operations has declined. To ensure and sustain its public drinking water system, the City needs in place—as soon as possible—a qualified manager with utility management expertise and with the ability to make changes to the System's operation, staffing, and financing processes to minimize the recurrence of pressure losses and boil-water notices.

I declare under penalty of perjury that the foregoing is true and correct.

Executed this 28th day of November, 2022, in Atlanta, Georgia.



Brian Smith

Exhibit 1: 2022 Assessment

**City of Jackson Distribution System Assessment:
Summary of Findings and Assessment Team Recommendations**

July 2022

Prepared by:

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Contributing Agencies:

**USEPA Region 4 (Region 4)
USEPA Technical Support Center (TSC)
Mississippi State Department of Health (MSDH)**

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BACKGROUND

The City of Jackson (COJ) operates two community water systems that serve the City and neighboring areas. The larger system is a surface water system with two treatment plants. The distribution system of each COJ community water system is operated independent of the other. The surface water system utilizes a chloramine residual as a secondary disinfectant, whereas the groundwater system uses a free chlorine residual. The service population of the surface water system is approximately 160,000 customers. The other water system has several well sources and serves approximately 16,000 customers in Southwest Jackson.

Region 4 became more engaged with COJ in 2016 when a significant Lead Action Level exceedance occurred in the southern section of the distribution system. In response to the COJ's Lead and Copper Rule (LCR) issues, Region 4 joined Mississippi State Department of Health's (MSDH's) efforts to help the COJ return to compliance with state and federal regulations.

NEIC Investigation – February 2020

EPA's National Enforcement Investigation Center (NEIC) conducted an investigation of the COJ's water system on February 3 – 7, 2020. NEIC's team documented significant deficiencies in both the surface water and groundwater distribution systems. They discovered that both surface water treatment plants were in poor operating condition and not maintained well, contributing to poor water quality and availability in the distribution system.

EPA Region 4 Enforcement Responses – 2020 to Present

Following the NEIC investigation, Region 4 issued a SDWA §1431 Emergency Order on March 27, 2020, in response to the imminent and substantial endangerment of Jackson's water customers. A SDWA §1414 Administrative Order on Consent was issued on July 1, 2021. Both orders mandated that the COJ repair both treatment and distribution systems on an established schedule.

MSDH Bureau of Public Water Supply Sanitary Surveys

The MSDH conducted sanitary surveys in February 2020 and November 2021. Both surveys identified significant deficiencies. Overall, the water systems were not operated and maintained properly at the time of both sanitary surveys.

Financial and Governance Assessments by the Environmental Finance Center

Using ARPA funding, Region 4 contracted with the Environmental Finance Center (EFC) at the School of Government at the University of North Carolina. The EFC is performing a financial health checkup and affordability assessment for the water and sewer enterprise fund and a review of the current governance structure of Jackson's water operations.

Distribution System Assessment

The Region 4 drinking water program identified the need for compliance assistance focused on the distribution systems for both the surface water and groundwater systems that the COJ operates. Region 4 drinking water program staff, through participation in EPA's Area-Wide Optimization Program (AWOP), concluded that using optimization tools to examine the distribution systems could inform the development of a blueprint for the COJ to move forward and make sound investments in rehabilitating the distribution infrastructure and improving operations. See [AWOP Overview](#) for a description of the program. Region 4 staff collaborated with TSC's AWOP staff to organize a team and arrange for a distribution system assessment which was initiated by a site visit to the COJ on March 2 – 3, 2022.

APPROACH

The Assessment Team worked with COJ staff to obtain pertinent historical data for review and analysis of distribution system performance. No additional water quality samples were obtained during the site visit. The team, comprised of representatives from Region 4, TSC's AWOP staff, Process Applications, Inc. (PAI), and MSDH, assessed water quality against AWOP distribution system goals (described in the Appendix, see Figure 1) and water line breaks against Partnership for Safe Water Distribution System (PSW DS) goals (see [PSW DS Program Overview](#)). Meeting those goals will not only lead to compliance but will ultimately result in water quality improvements that go beyond compliance. While evaluating the performance of the two COJ water systems relative to optimization goals, the team identified a number of findings and recommendations for improvement.

FINDINGS

Distribution System Operation and Maintenance

Line Breaks:

1. Water line break data from 2017 through 2021 indicate that line breaks occurred at an average annual rate of 55 breaks per 100 miles of line. The rate exceeded the Partnership for Safe Water's recommended goal of 15 breaks per 100 miles of line per year and the five-year trend is upward, but the rates have declined in the two most recent years. See Figure 2 in the Appendix.
2. Spatial analysis of water line breaks showed distinct areas within the COJ distribution systems with a high number of breaks, including the North Jackson and Seneca Street areas. These areas corresponded to locations where small diameter pre-1910 cast iron pipe is still in use. See Figures 3 – 5 in the Appendix, juxtaposing water main break density maps with pipe size maps from 2013 COJ Master Plan.

General Operation and Maintenance:

In part due to lack of staff, the following four activities are not being conducted in the COJ distribution systems. These could be implemented by internal COJ staff or with contractor support.

1. The COJ does not collect and record continuous pressure data, which could be used to identify areas in need of pressure improvements to prevent contamination in the distribution system.
2. Routine flushing of the distribution system has not been performed. Flushing can be utilized to reduce water age and optimize chlorine residuals.
3. Valve locations and operational status are not well documented. This could result in large areas being affected by main breaks and low-pressure events, since isolation valves cannot be located.
4. Valves and hydrants have not been routinely exercised, and maintenance has not been performed. This could result in areas of the distribution system being impacted by valves that cannot be opened (i.e., water is not flowing into an area where it is needed) or valves that cannot be closed (i.e., water could be moving unintentionally from one area to another).

Storage Tanks:

1. Many storage tanks have been cycling infrequently since early 2021. Tanks with high average turnover times included Forest (42.5 days), Mill Street (46.6 days), and Cedar Hills (51 days). Average turnover times of less than five days will generally maintain an adequate chlorine residual in the distribution system. The Maddox and Spring Hill tanks were not evaluated because the tank levels never changed (i.e., water was not draining from or filling the tanks). See Table 1 in the Appendix for a summary of tank turnover times.
2. Mixing performance ratios for eight of 17 tank evaluations showed the potential for poor mixing when compared to a recommended mixing performance ratio of ≥ 1.0 . The mixing performance ratio is an estimate of the ratio between the actual level of mixing and desired mixing (the level of mixing required to achieve 95 percent uniformity throughout the tank). When actual mixing is equal to or greater than a theoretical desired level of mixing, (mixing performance ratio ≥ 1.0), chlorine residuals are expected to be maintained. See Table 1 in the Appendix for a summary of tank mixing performance ratios.
3. The southern-most elevated storage tank on the surface water distribution system (the Byram tank) has never filled as expected. Startup of a bottling plant near the Byram tank increased demand and caused additional difficulty in filling the tank.

Customer Complaints:

1. An analysis of customer complaint data from 2011 through 2022, that was provided by the water utility, indicated the following:
 - A. Discolored water complaints have been trending lower in recent years, as indicated in Figure 6 in the Appendix.
 - B. There was a huge spike in pressure complaints in January 2018 (521 complaints documented that month). Pressure complaints have increased since 2014, from 5 - 10 per month to 10 - 30 per month, as indicated in Figure 7 in the Appendix.
 - C. Odor complaints have been increasing on a monthly basis since 2016, as indicated in Figure 8 in the Appendix.

Groundwater Distribution System Water Quality

1. Disinfectant Residuals –

- A. Free chlorine residuals at the points of entry to the distribution system generally ranged from 0.5 mg/L (Wiggins Road) to 4.2 mg/L (Siwell Road). Example free- and total-chlorine residual paired-sample results for the Wiggins Road and Siwell Road sites are shown in Figures 9 and 10 in the Appendix. The trend graphs represent data collected from daily monitoring performed by operators at the first customer after each chlorination facility in the groundwater system. Trends at the other chlorination facilities fall within the range indicated in the example charts.
- B. Free chlorine residual varied from 0.3 to 3.4 mg/L in monitoring of nineteen different locations in the groundwater distribution system between January 2021 and February 2022. This system met the free chlorine residual optimization goal of ≥ 0.20 mg/L in 100 percent of compliance samples evaluated during this time period. It is not known, however, whether the samples were collected in a manner that would represent the quality of water in the main at the sample site (e.g., sample was collected using a calculated flush time or volume, etc.).
- C. Total and free chlorine residuals are measured throughout the system. The difference between total and free chlorine residual ranged from 0.3 to 0.5 mg/L entering the distribution system from the wells, and it was as high as 2.5 mg/L within the distribution system, based on data collected in the year prior to the site visit. Figure 11 in the appendix shows the annual average free and total chlorine residuals for each monitoring location within the COJ groundwater system.
 - 1) Mapped data indicated large differences between total chlorine and free chlorine on the eastern side of the groundwater distribution system; large differences between the free and total chlorine residuals could indicate an interference in the free chlorine measurement. Many sites were near the presumed groundwater and surface water systems' boundaries.
 - a) Specific locations include areas along Maddox and Raymond Roads.
 - b) Additional isolated locations of this same trend were identified.
 - c) An example of these trends is provided in Figure 12 of the Appendix.

- 2) Groundwater with a free chlorine residual would be expected to have similar free and total chlorine residuals. Because the surface water carries a chloramine residual and the groundwater system carries a free chlorine residual, the discrepancy between total chlorine and free chlorine residuals may indicate that surface water is entering the area of the system supplied by groundwater, due to leaking or inadvertently open valves.
2. Disinfection By-products – Limited TTHM and HAA5 data (April 2021 through January 2022) were available for review in this portion of the distribution system. The TTHM data met regulatory requirements and met the individual site optimization goal ($\text{LRAA} \leq 0.070 \text{ mg/L}$) at all sites, but there was not enough quarterly data to assess system performance against the long-term optimization goal (average maximum LRAA from the past eight quarters $\leq 0.060 \text{ mg/L}$). With respect to HAA5s, two of the four sites exceeded the individual site optimization goal ($\text{LRAA} \leq 0.050 \text{ mg/L}$), with values of 0.052 and 0.058 mg/L.

Surface Water Distribution System Water Quality

1. Disinfectant Residuals – The surface water system met the total chlorine residual optimization goal of 1.50 mg/L in 67 percent of compliance samples evaluated between May 2018 and February 2022. Some sites within this system were meeting the goal in less than 10 percent of samples. Discussions with the staff responsible for collecting samples indicated that sampling may not be representative of distribution system water quality (e.g., if a low chlorine residual was detected, the sampler initiated low volume flushing by opening a hydrant and returned later to re-collect the sample). In this case, only the higher (post-flush) chlorine residual was recorded. Figure 13 in the Appendix shows the percent of total chlorine residuals meeting the optimization goal, by sample location, during the time period analyzed. The percentages would likely have been lower for each site if the initial chlorine measurement data were recorded prior to flushing.
2. Disinfection By-Products – Data were reviewed for the surface water system for the period of February 2018 through October 2021. Between February 2019 and October 2021, this system met the individual site goal ($\text{LRAA} \leq 0.070 \text{ mg/L}$) at all sites and the system long-term optimization goal for TTHMs (average maximum LRAA from the past eight quarters $\leq 0.060 \text{ mg/L}$), based on the available data (see Figure 14 in the Appendix). During this same period, five of eight monitoring sites, with at least four quarters of data, exceeded the HAA5

individual site optimization goal ($\text{LRAA} \leq 0.050 \text{ mg/L}$) in 14 quarterly LRAA calculations, as shown in Figure 15 in the Appendix. Overall, TTHMs and HAA5s are decreasing in the surface water portion of the distribution system.

3. Water Quality Parameters (WQPs).

- A. The distribution system entry point pH at both surface water treatment plants (SWTPs) was frequently outside of the assigned optimized water quality parameter (OWQP) pH range of 9.0 – 9.5 units between March 2021 and February 2022. See Figure 16 in the Appendix.
- B. The Curtis plant entry point alkalinity generally met the goal of $\geq 15 \text{ mg/L}$ (only one sample below this minimum was collected). The Fewell plant had several instances of entry point alkalinity measurements below the minimum OWQP of 15 mg/L. See Figure 17 in the Appendix.
- C. Monthly distribution system pH data for February 2018 through February 2022 showed a variation from 6.84 – 9.75 units, indicating that the WQP goal for distribution system pH (> 8.6 units) was not always met. See Figure 18 in the appendix.
- D. In monthly distribution system data collected between February 2018 and February 2022, alkalinity varied from 3 to 60 mg/L and increased in variability over time, indicating that the WQP goal for distribution system alkalinity ($\geq 15 \text{ mg/L}$) was not always met. See Figure 19 in the Appendix.
- E. The SWTPs feed different chemicals (e.g., lime and soda ash to supplement alkalinity).

4. Chloramination.

- A. Spikes in the finished water free chlorine residual at the Curtis plant in spring and autumn of 2021 indicated a disruption in chloramine process control. The ammonia feed rate is programmed into SCADA and cannot be easily adjusted by operations staff, which may lead to either overfeeding or underfeeding ammonia (i.e., improper chlorine-to-ammonia ratio). See Figure 20 in the Appendix for March 2021 through February 2022 data.
- B. During the 12 months prior to the assessment, the monochloramine residual in the Curtis plant effluent was at times less than the optimization goal of 1.5 mg/L. See Figure 20 in the

Appendix for an example of the monochloramine residuals at the point of entry from the conventional plant.

- 1) The Fewell plant effluent showed less variability in total chlorine and monochloramine residual than the Curtis plant over the past 12 months, indicating relatively better process control. See Figure 21 in the Appendix.
 - 2) The plant staff target a free ammonia goal of 0.1 – 0.3 mg/L at both plants, but data reviewed for the previous 12 months indicated some periods when free ammonia was ≥ 0.55 mg/L as N, which is the maximum detection limit of the method used for analysis. Free ammonia above the optimization goal of ≤ 0.10 mg/L as N may contribute to nitrification in the distribution system. Figures 22 and 23 in the Appendix show the free ammonia levels at the Curtis conventional plant and the Fewell plant.
 - 3) Historical chloramination process control may have been impacted by lack of functional equipment in addition to operational practices.
5. Continuous chlorine analyzers were being improperly calibrated and maintained at the time of the visit. Verification standards were not available for portable chlorine test kits.

Administration

1. The Utilities Manager position was vacant at the time of the visit. The COJ explained that this was due to budget limitations.
2. There was no succession plan for the utility at the time of this site visit.
3. Jackson's water utility is governed by the Jackson City Council and does not currently operate as an independent enterprise. The University of North Carolina Environmental Finance Center (EFC) is evaluating the current governance structure to determine whether another model would be successful in Jackson.
4. Considerations related to staffing were included in reports generated for the COJ in 2015 (Raftelis Financial Consultants) and 2021 (Jacobs). In addition, MSDH staff have provided staffing level recommendations to the COJ.

- A. There are insufficient operators to consistently staff three shifts, seven days per week. Staff are unable to take time off without forcing remaining staff to work extra hours. Supervisors are working shifts in addition to their managerial responsibilities. Distribution system crews are sparsely staffed and are unable to conduct preventive maintenance.
 - B. Operator turnover is high. Operators indicated instances of working up to 75 hours per week without receiving overtime pay.
 - 1) The City Council approved salary increases for treatment plant operators in November 2021.
 - 2) No salary increases for maintenance technicians, instrument technicians, or distribution system staff have been implemented to date, coinciding with a loss of staff in these roles.
 - C. The COJ relies on a consultant for operator training and treatment advice.
 - D. The utility does not have adequate plant and distribution system staff to perform preventative maintenance that could reduce overall operational costs of the system.
5. Plant administrators indicated that malfunctioning water meters have contributed to a 32 percent decrease in revenue since 2016. While meters are currently being replaced, there is uncertainty about whether the new meters will be capable of communicating with the billing system.
- A. COJ explained to EFC staff that the City's billing system and meter replacement project may take 18 months to complete. At the time of the EFC Kick-off meeting in March of 2022, approximately 14,000 bills were recently "*stranded*" (i.e., not sent to/received by customers).
 - B. COJ reported to the EFC that non-revenue water is ~50 percent; it is unclear how much is due to meter issues or water loss.
 - C. Due to problems with the billing system, COJ was unable to provide a complete list of customers at the time of the visit. COJ explained that some customers were not receiving bills, others were receiving large bills, solid waste charges were not being included as they should be, etc. The COJ cannot currently calculate its collection rate. This is not expected to be resolved until late 2024.

6. An analysis conducted by the EFC illustrates that Jackson's enterprise fund revenues have been rapidly decreasing since 2015. Metrics (such as operating ratio, debt service coverage ratio, day's cash on hand) that should be staying level or increasing are decreasing. The billing and metering issues are a big contributor to this loss in revenue as well as a loss of large customers (i.e., hospitals and local schools).

RECOMMENDATIONS

Towards meeting optimization goals and improving public health protection, the Assessment Team recommends that COJ consider the following prioritized actions and implement them, as practical, to improve public health protection. These recommendations will require a commitment of resources by COJ; some may be implemented by current staff, while others may necessitate additional staff or contractor resources.

1. Develop a plan to document valve locations and positions (open/closed) and develop a standard operating procedure for exercising valves and hydrants.
2. Conduct continuous pressure monitoring in the distribution system to characterize pressure loss issues.
3. Develop and implement a flushing program to improve distribution system water quality.
4. Conduct investigative sampling in the surface water portion of the distribution system to assess performance against the monochloramine residual goal of 1.5 mg/L and related chloramine parameters.
5. Develop a surveillance plan to detect the occurrence of nitrification in the distribution system.
6. At the surface water treatment plants, ensure chemical feed equipment is operational and reliable and provide chloramination process control training on chlorine dosing, entry point monochloramine residual, and free ammonia targets.
7. Conduct investigative sampling in the groundwater system, beginning at the wells and moving into the distribution system, to analyze water quality parameters (e.g., total chlorine, free chlorine, monochloramine, free ammonia, pH, others) and conduct a careful review of groundwater/surface water system boundaries and valve locations/positions.

8. Evaluate and implement HAA5 control strategies for groundwater and surface water sources.
9. Once desired corrosion control treatment is installed, implement process control related to pH and alkalinity adjustment at the treatment plant.
10. Perform investigative water quality monitoring near selected tanks to assess whether tank operation is having a negative impact on distribution system water quality.

APPENDIX

Area-Wide Optimization Program Disinfection By-Product and Distribution System Optimization Goals and Guidelines¹

Monitoring & Operating Goals Summary

Category	Goal/Guideline	Status	Description	References
Disinfection By-Product	Plant Effluent Monitoring Goal	Adopted	Collect quarterly total trihalomethane (TTHM) and haloacetic acid (HAA5) samples at the plant effluent with distribution system compliance sites.	WRF Project #4109
Disinfection By-Product	Enhanced Coagulation Monitoring Goal ²	Adopted	Collect monthly raw and treated water total organic carbon (TOC) samples.	Stage 1 D/DBP Rule
Disinfection By-Product	Disinfection Monitoring Goal	Adopted	Record disinfectant residual, temperature, and pH at maximum daily flow in the treatment plant for CT calculations.	U.S. Environmental Protection Agency, 2004
Distribution System	Disinfection By-Product Monitoring Goal	Adopted	Collect quarterly DBP samples at all compliance locations at systems in compliance with the Stage 2 D/DBP Rule. Collect monthly DBP samples at all compliance locations at system <i>not</i> in compliance with the Stage 2 D/DBP Rule.	Stage 2 D/DBP Rule
Distribution System	Disinfectant Residual Monitoring Goal	Adopted	Monitor disinfectant residual at bacteriological and DBP compliance sites, all active distribution system entry points, all storage tanks (preferably while draining), and at a minimum of four critical sites (one in each quadrant of the system) identified by investigative sampling. Conduct monitoring at least monthly and more frequently during warmer weather.	American Water Works Association, 2013 American Water Works Association, 2017
Distribution System	Chloramination Process Monitoring Goal	Adopted	Monitor free ammonia in raw water, prior to the addition of chlorine in the treatment plant, and in the plant effluent on a routine basis. Raw water should be monitored at least weekly and other locations should be monitored at least daily. The frequency of analysis at each location should be adjusted based on variability.	American Water Works Association, 2013
Distribution System	Nitrification Monitoring Goals	Adopted	Monitor monochloramine, free ammonia, and nitrite at system entry points and in the distribution system (see <i>Disinfectant Residual Monitoring Goals</i> for locations and frequency). Monochloramine and free ammonia should be monitored at all locations. Nitrite should be monitored at samples locations where monochloramine is ≤ 1.50 mg/L; nitrate may also be monitored to further assess nitrification.	American Water Works Association, 2013

Performance Goals & Guidelines Summary

Category	Goal/Guideline	Status	Description	References
Disinfection By-Product	Plant Effluent Performance Goal	Adopted	Adopt System Specific Targets: Discrete value or range based on a running annual average (RAA). Suggested goals may be 30% to 50% of long-term locational running annual average (LRAA) goals (e.g., 20-30 ppb for TTHM, 15-20 ppb for HAA5).	WRF Project #4109
Disinfection By-Product	Enhanced Coagulation Performance Goal ¹	Adopted	Meet Stage 1 D/DBP Rule TOC removal requirements for enhanced coagulation, which are based on source water alkalinity and TOC levels, or an alternative compliance criterion, as a RAA of the performance ratio (PR) (actual/required removal) plus a factor of safety of 10% (or $PR \geq 1.1$).	Stage 1 D/DBP Rule
Disinfection By-Product	Disinfection Performance Goal	Adopted	Meet CT requirements to achieve inactivation of Giardia and viruses plus a system-specific factor of safety.	U.S. Environmental Protection Agency, 2004
Disinfection By-Product	Disinfection By-Products Performance Goals	Adopted	Individual Site Goal: Quarterly maximum LRAA TTHM/HAA5 values not to exceed 70/50 ppb. Long-Term System Goal: Average of maximum LRAA TTHM/HAA5 values not to exceed 60/40 ppb (the average of the last 8 quarters cannot exceed 60/40 ppb).	Under Development
Distribution System	Disinfection Performance Goals	Adopted	Maintain ≥ 0.20 mg/L free chlorine residual at all monitoring sites in the distribution system, at all times in systems that use free chlorine as a secondary disinfectant. Maintain ≥ 1.50 mg/L monochloramine residual at all monitoring sites in the distribution system, at all times. In systems that use chloramines as a secondary disinfectant.	American Water Works Association, 2013 American Water Works Association, 2017
Distribution System	Chloramination Process Performance Goal	Adopted	Maintain a detectable free ammonia residual in the plant effluent ≤ 0.10 mg/L as NH_3-N .	American Water Works Association, 2013
Distribution System	Chlorine and Ammonia Dosing Operational Guideline	Adopted	Maintain a chlorine-to-nitrogen mass ratio between 4.5:1 and 5.0:1 (or chlorine-to-ammonia mass ratio between 3.7:1 and 4.1:1) which should result in a detectable free ammonia in the plant effluent that is ≤ 0.10 mg/L as NH_3-N .	American Water Works Association, 2013
Distribution System	Storage Tank Operational Guideline	Adopted	Maintain an average turnover time < 5 days; or establish and maintain an acceptable water turnover rate at each storage facility to maintain water quality. Maintain good mixing (i.e., $PR^3 \geq 1$) at all times; for tanks where the PR cannot be calculated, adequate mixing (i.e., uniform water quality) should be confirmed by alternate means (e.g., tank profiling/water quality sampling).	WRF Project #254 Grayman et al., 2000

Footnotes:

¹Applies to locations at BOD, surface water (SW), and groundwater under the direct influence of surface water (SW/DL) treatment plants unless otherwise noted.²Only applies to full and partial treatment plants.

Monitoring performance ratio is determined using the FWS Storage Tank Assessment Spreadsheet.

References:

American Water Works Association. (2013). *Reference to Water Quality Parameters: TTHM, HAA5, and Chloramine*. Retrieved from <http://www.awwa.org/Assets/2013/01/01/Reference-to-Water-Quality-Parameters-TTHM-HAA5-and-Chloramine.pdf>

Grayman, W. M., Benmar, A., Arnold, C., DeLong, B. A., Smith, L. E., & Schaefer, R. (2000). *Water Quality Modeling of Distribution System Storage Facilities*. Denver: American Water Works Association Research Foundation.

Grayman, W. M., Benmar, A., Arnold, C., DeLong, B. A., Smith, L. E., & Schaefer, R. (2000). *Water Quality Modeling of Distribution System Storage Facilities*. Denver: American Water Works Association Research Foundation.

Stage 1 Disinfection and Distribution Operational Rule Stage 1 D/DBP Rule. January 1, 2004. Vol. 72, No. 2.

Stage 2 Disinfection and Distribution Operational Rule Stage 2 D/DBP Rule. January 1, 2004. Vol. 72, No. 2.

Figure 1. Area-Wide Optimization Program Disinfection By-Product and Distribution System Goals

MAIN BREAKS/LEAKS CRITERIA - OUTPUT

Main Breaks and Leaks System-wide Summary Table	
Utility Name:	City of Jackson
Number of Occurrences/100 Miles of Pipe/Year:	
Average ¹	55.4
Minimum ²	18.5 (2017)
Maximum ²	71.0 (2019)
Number of Years:	
Analyzed	5
Criteria is Exceeded	5
Criteria is Not Exceeded	0
Since Last Exceedance	0
Annual Average Percent Change ¹ :	-0.9%
<p>Note 1. Annual Average Percent Change is the average annual percent increase or decrease based on the trend line shown on the 'Analysis' worksheet. of the trend line times 100.</p> <p>2. Minimum and maximum show the value and year of occurrence in parenthesis.</p>	

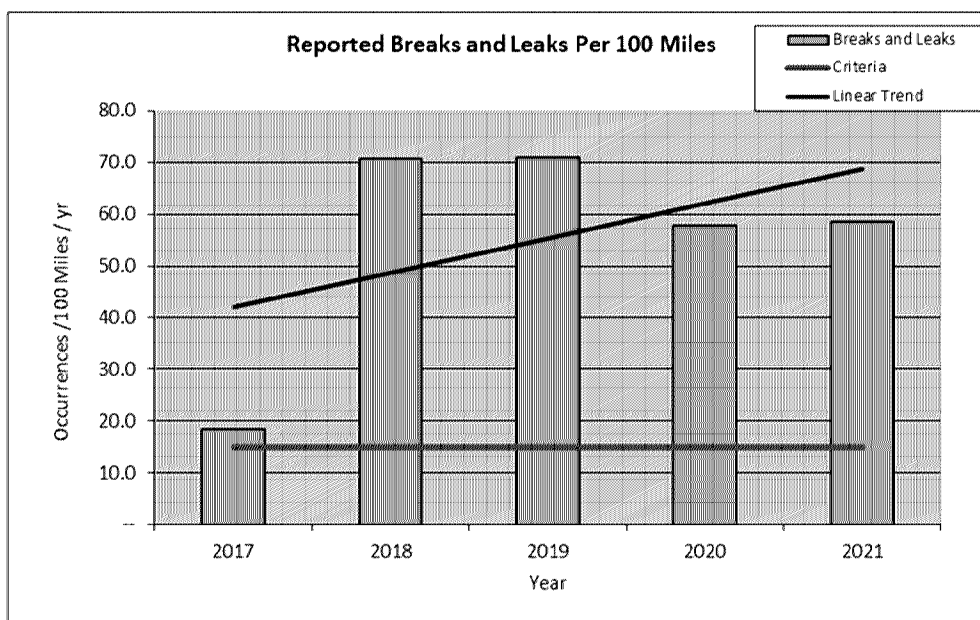


Figure 2. Line Break Assessment

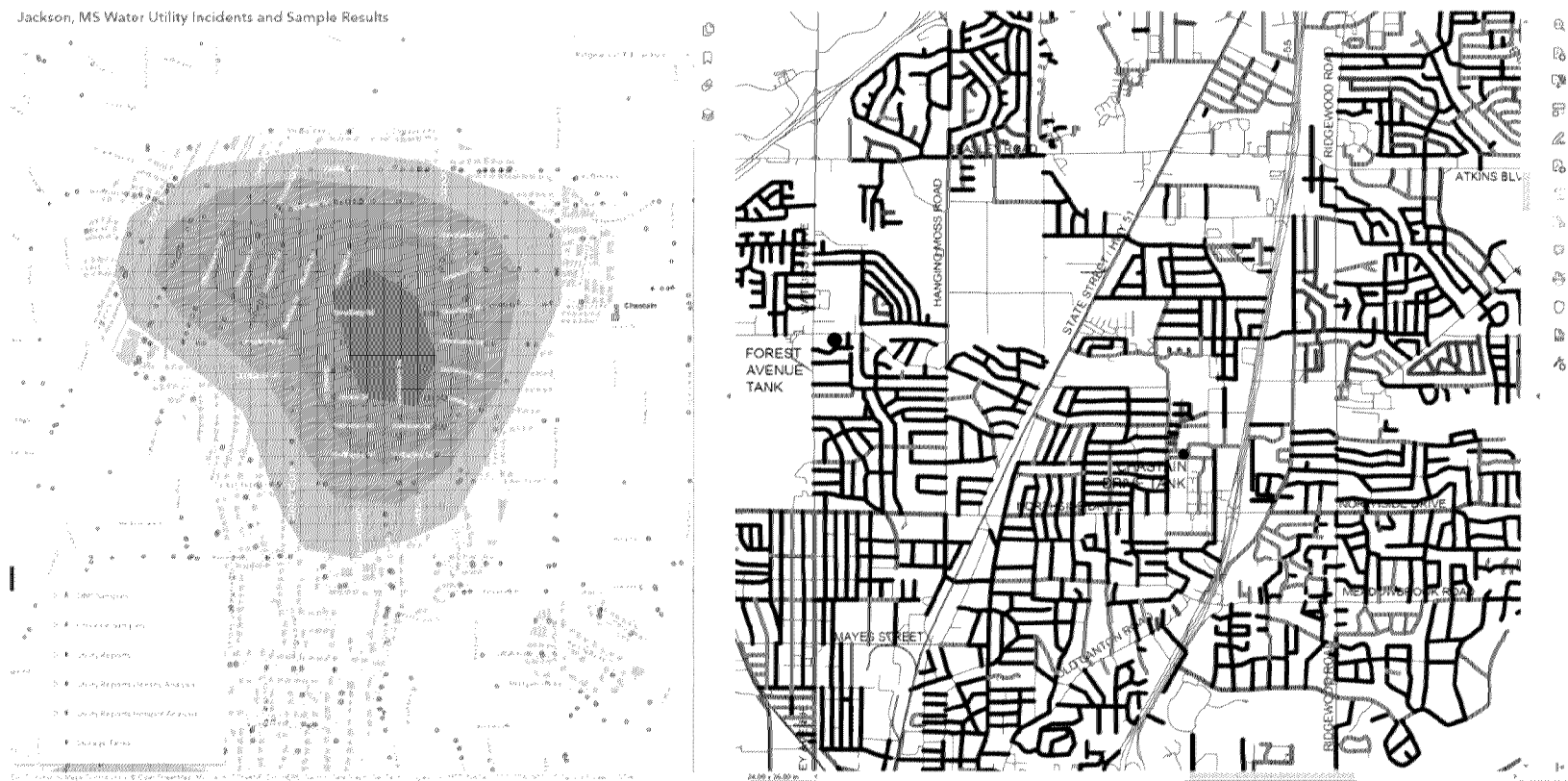


Figure 3. North Jackson Line Break Frequency (2017 through 2021)/Pipe Size Map

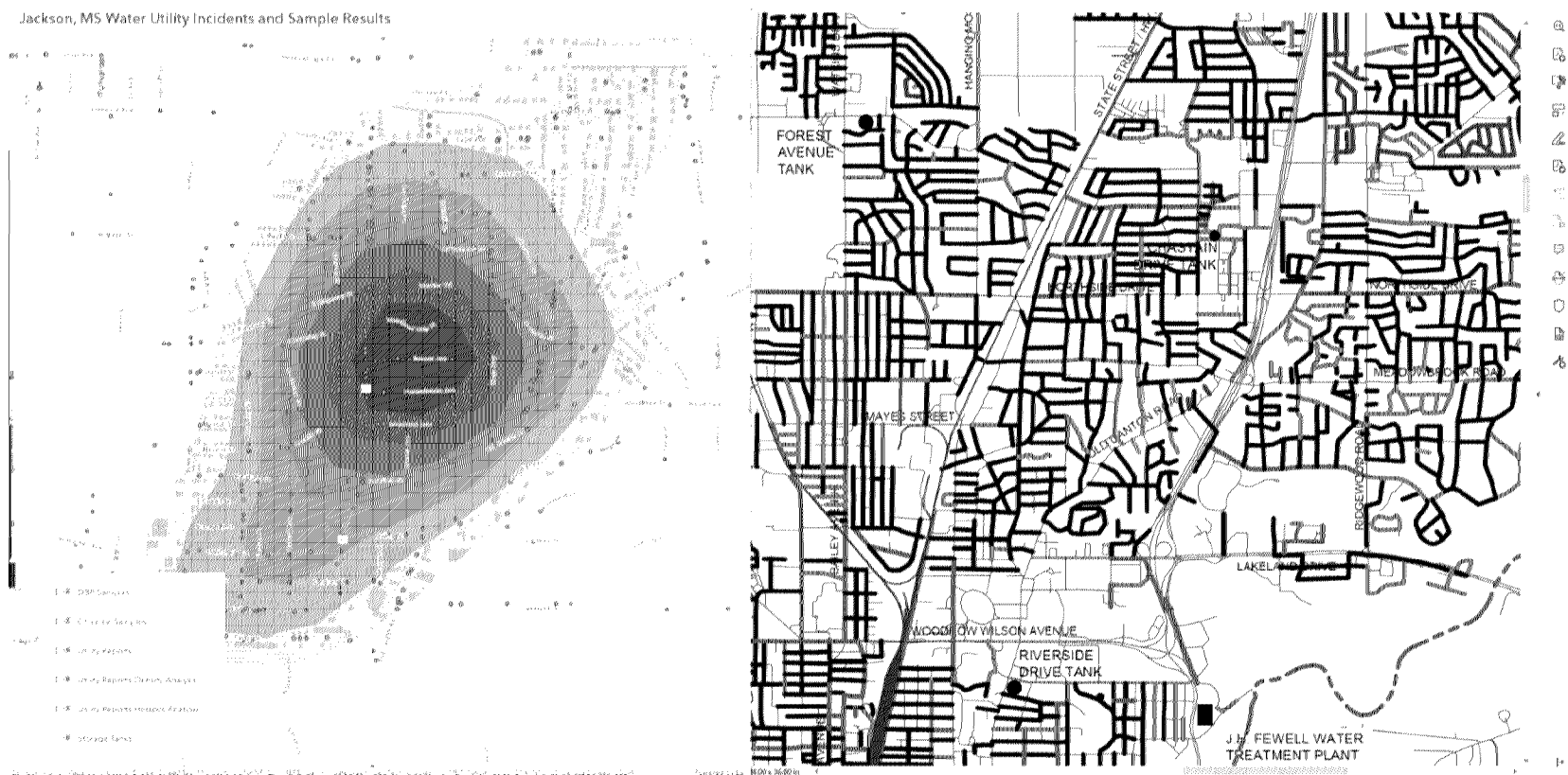


Figure 4. Seneca Street Area Line Break Frequency (2017 through 2021) /Pipe Size Map



Table 1. Jackson Storage Tank Performance Summary

Tank	Average Turnover Time (days)	Mixing Performance Ratio (Measured/Desired)
Chastain (Dec. 6 – 24, 2020)	5.9	0.97
Elaine (Dec. 6 – 21, 2020)	2.3	1.64
Forest (Jan. 2020 – Jan. 2021)	42.5	2.65
Northwest (Sep. 6 – Oct. 9, 2020)	7.6	1.18
Livingston Park (Dec. 6 – 22, 2020)	9.0	0.49
Riverside (Dec. 5 – 23, 2020)	7.7	0.72
Lynch (Dec. 6 – 22, 2020)	7.0	0.64
Suncrest (Jul. 1 – 16, 2020)	1.1	4.02
Mill St. (Jul. 1 – Aug. 27, 2020)	46.6	0.61
Mill Street (Dec. 1 – 30, 2020)	16	1.04
Magnolia (Jul. 1 – 9, 2020)	2.2	1.39
Magnolia (Dec. 5 – 14, 2020)	2.1	1.41
Byram	Out of service	
Presidential Hills (Jul. 2 – 16, 2020)	3.5	0.65
Presidential Hills (Dec. 6 – 11, 2020)	1.3	0.67
Groundwater System		
TV Road Collector	Out of service	
Maddox Road – Hwy18	Not analyzed	
Springridge (Summer)	11.7	0.75
Springridge (Winter)	TBD	TBD
Cedar Hills (Jun. 2020)	4.0	1.04
Cedar Hills (Nov. 2020 – Feb. 2021)	51	1.09

Count of Date Initiated

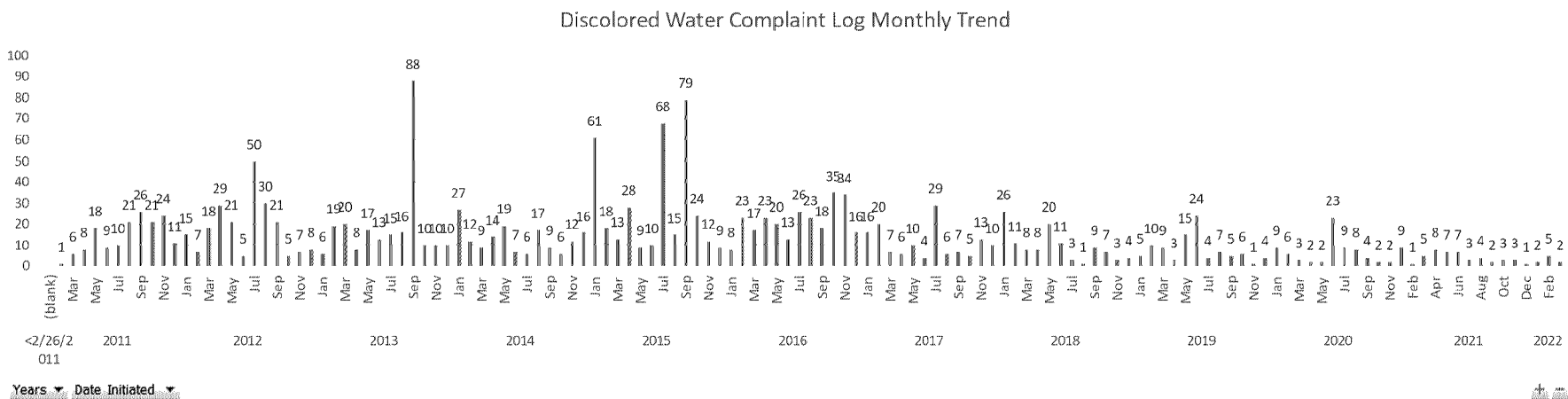


Figure 6. Long-Term Trend of Discolored Water Customer Complaints

Count of Date Initiated

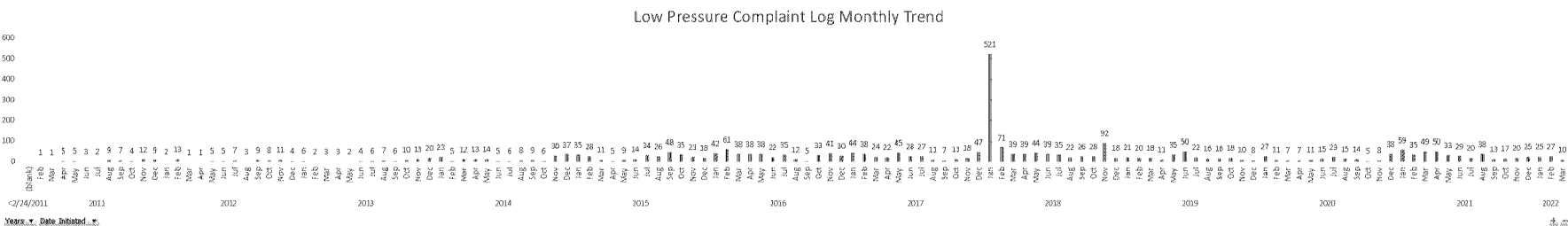


Figure 7. Long-Term Trend of Low-Pressure Customer Complaints

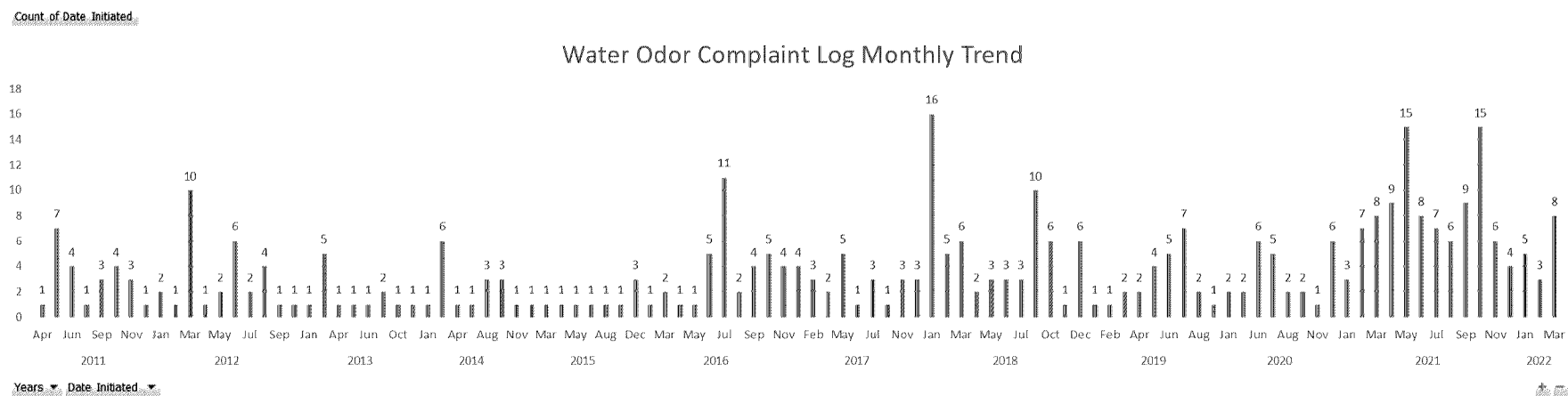


Figure 8. Long-Term Trend of Water Odor Customer Complaints

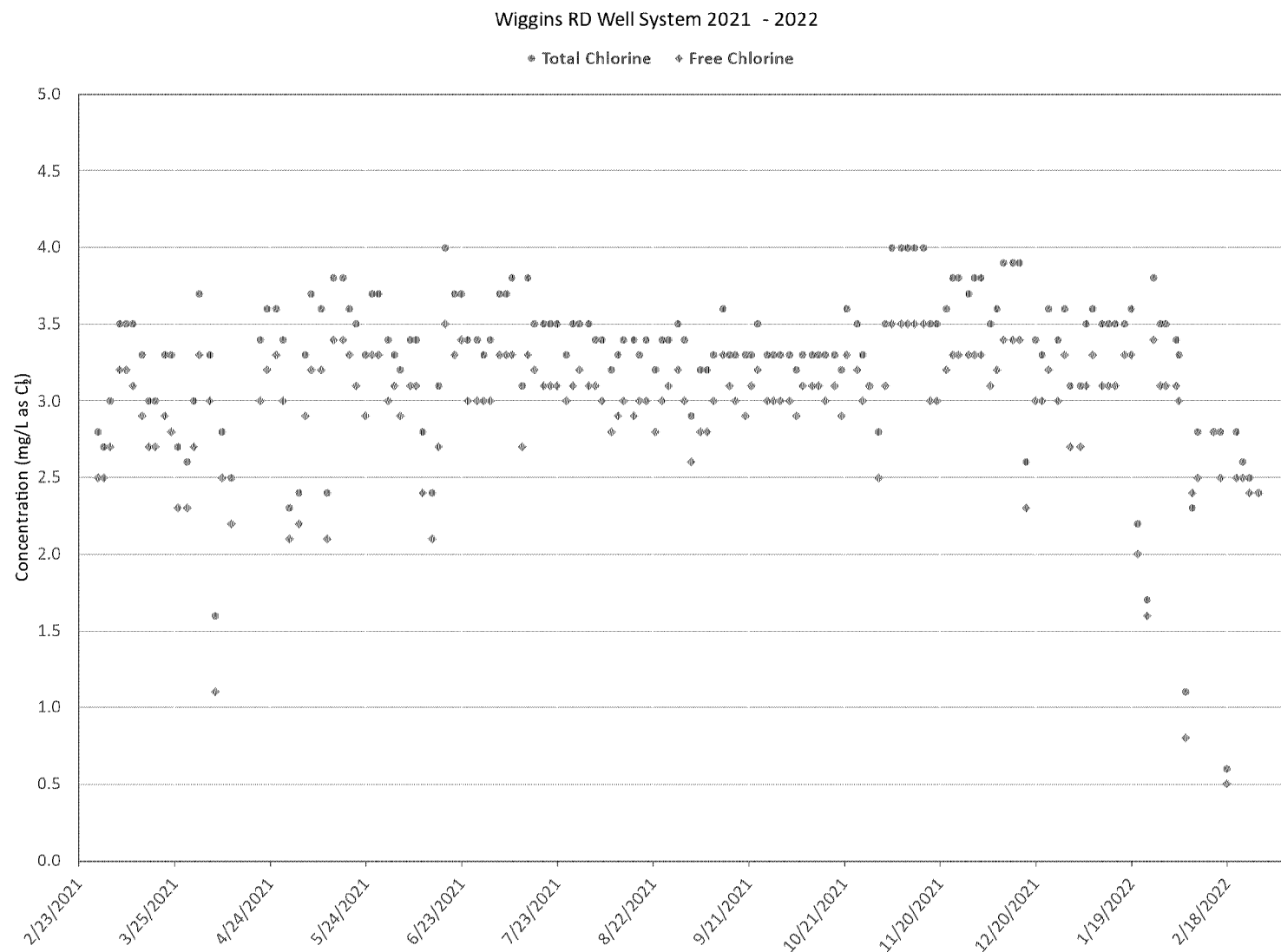


Figure 9. Long-Term Trend of Free and Total Chlorine Residual from Daily Monitoring at Wiggins Road First Customer Site

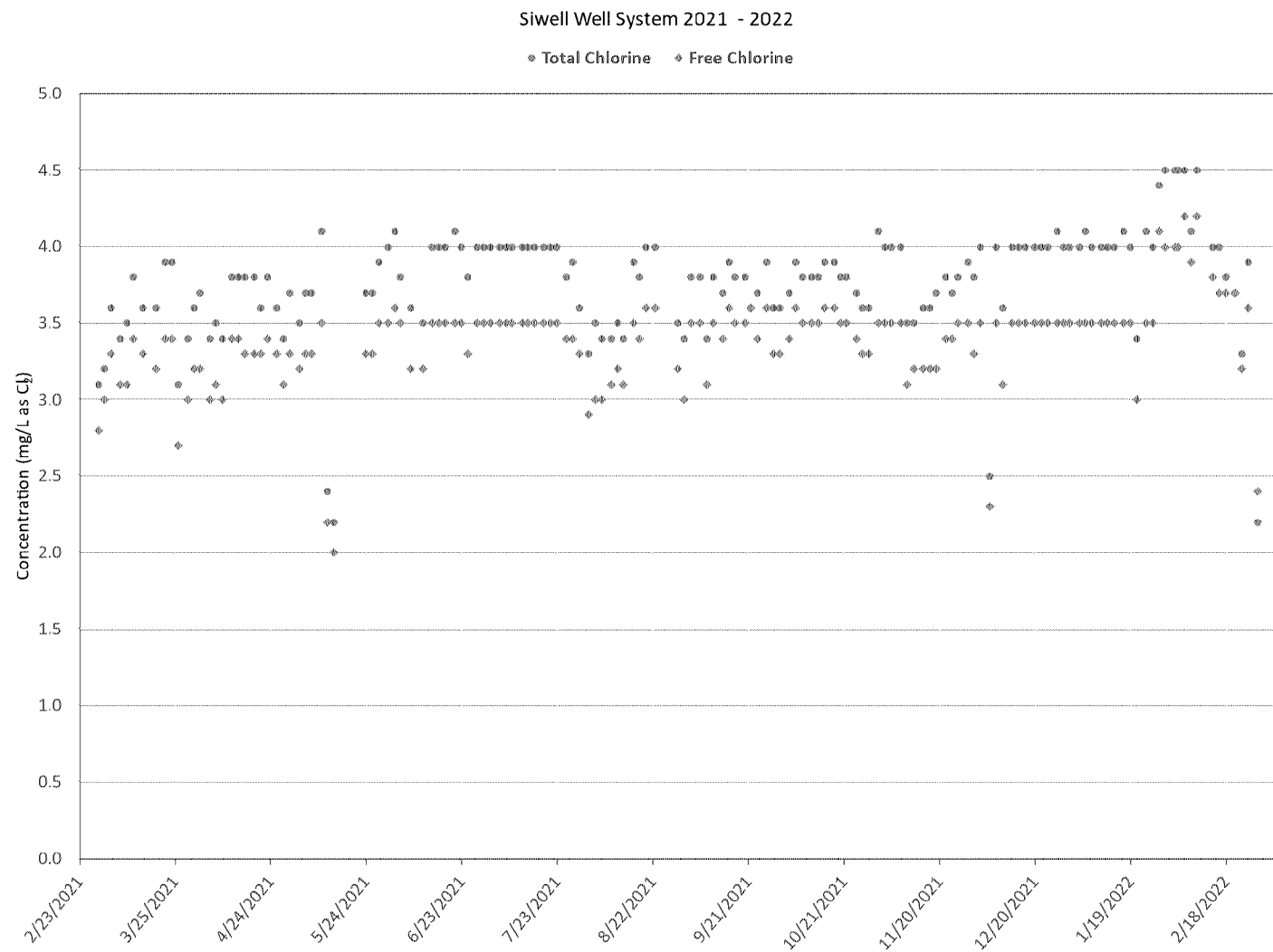


Figure 10. Long-Term Trend of Free and Total Chlorine Residual from Daily Monitoring at Siwell Road First Customer Site

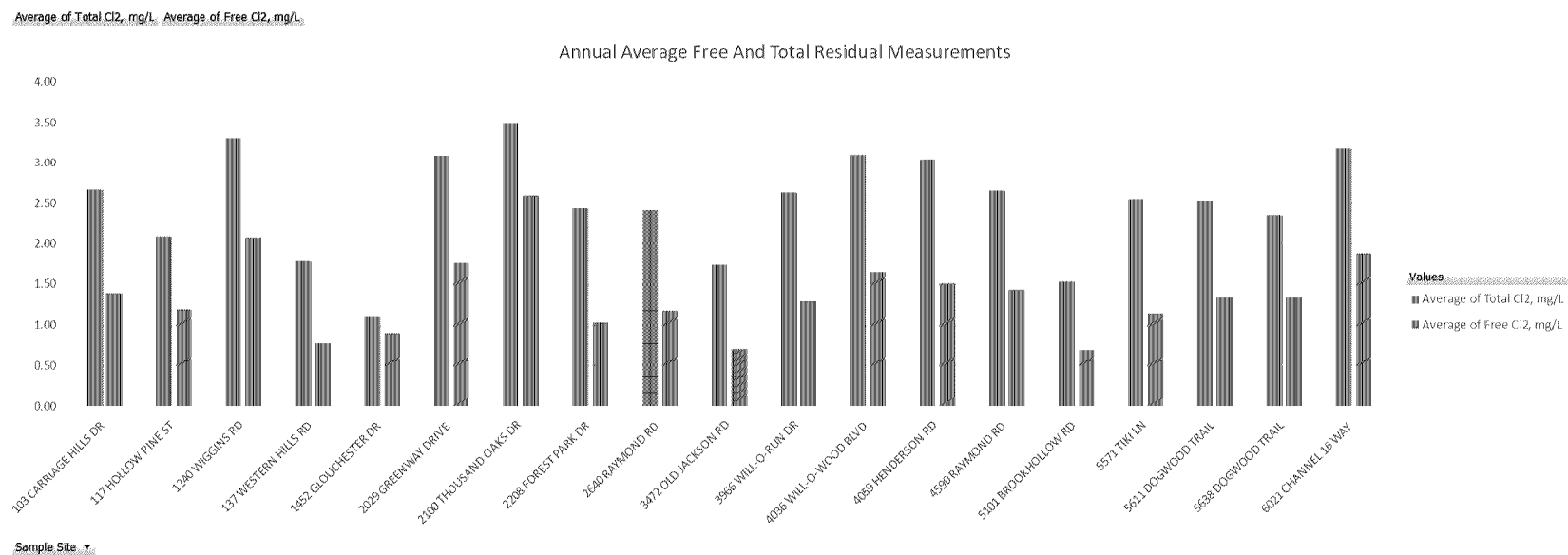


Figure 11. COJ GW System Distribution System Average Free and Total Chlorine Residual by Monitoring Location for the Year Preceding the Site Visit (January 2021 through December 2021)

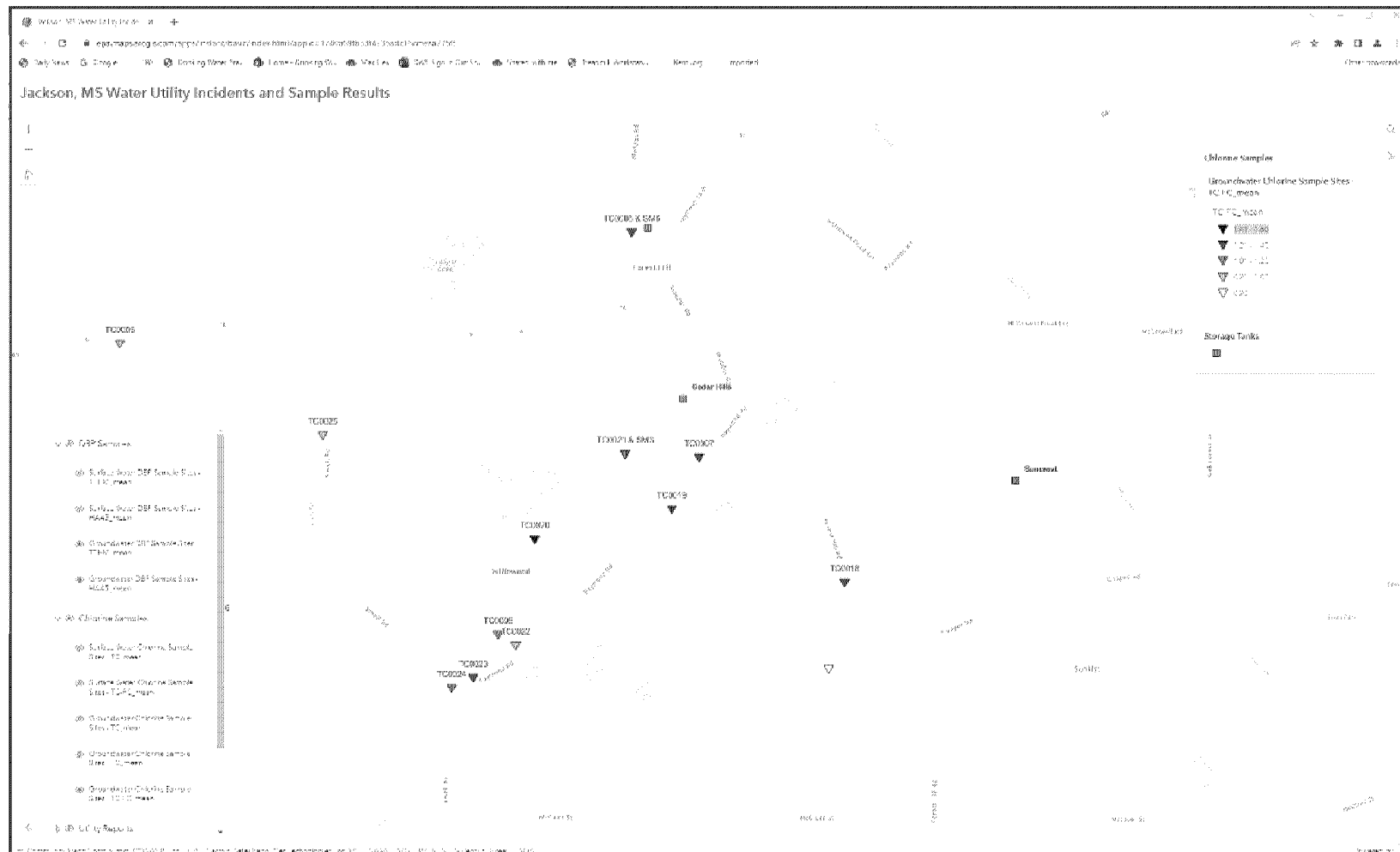


Figure 12. Example of Average Difference Between Total and Free Chlorine Residual in the Groundwater Distribution System (January 2021 through February 2022).
(The larger differences are plotted in red and appear near the boundary with the surface water system.)

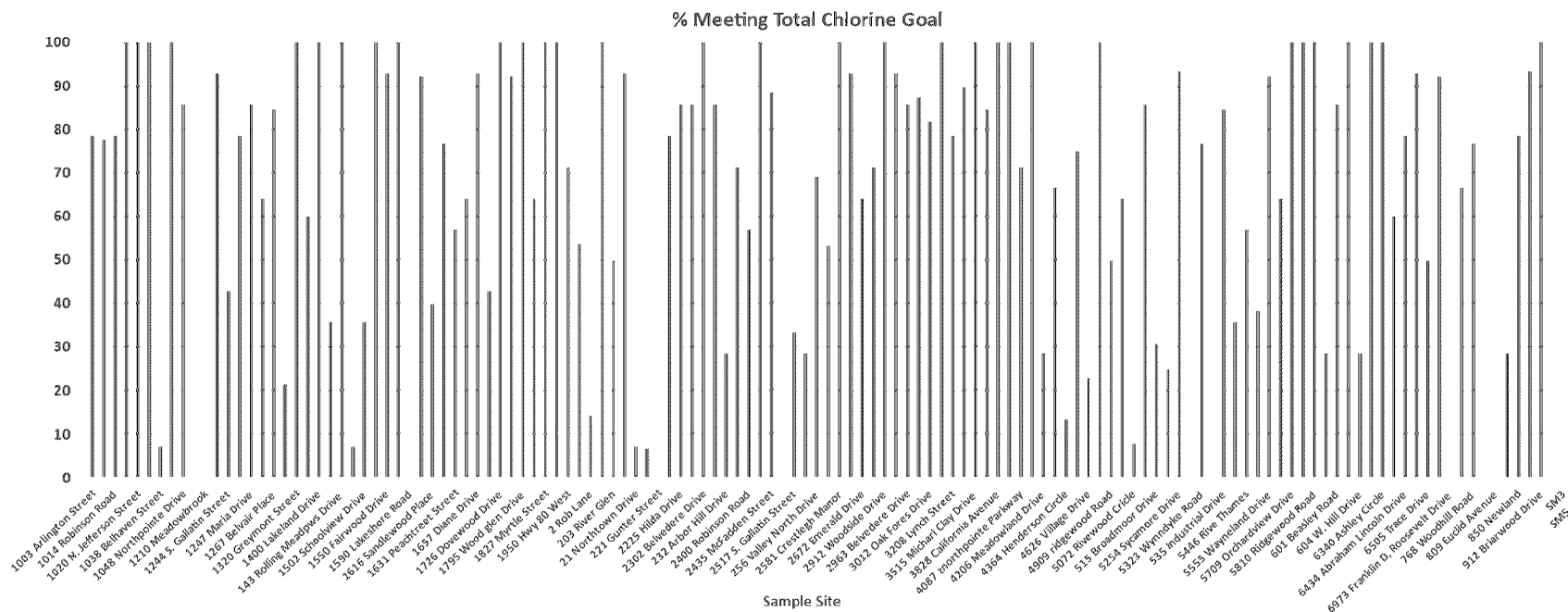


Figure 13. COJ Surface Water Distribution System Percentage of Monitoring Results Meeting the 1.5 mg/L Total Chlorine Goal by Monitoring Location (February 2018 through February 2022)

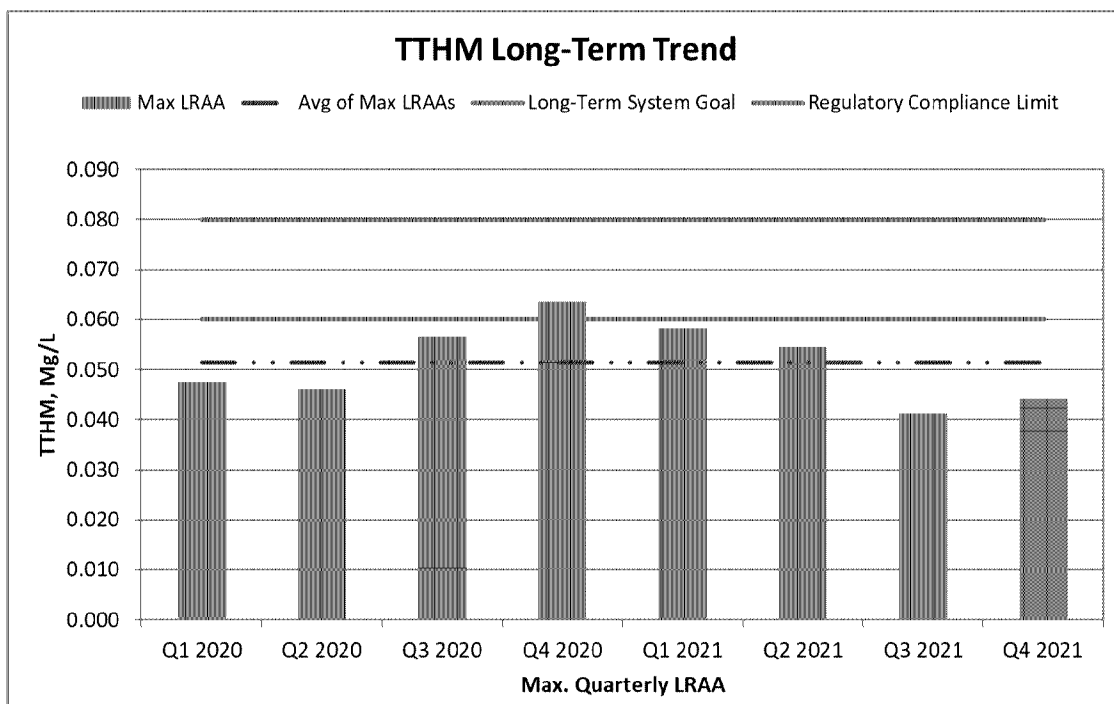


Figure 14. TTHM Long-Term Trend

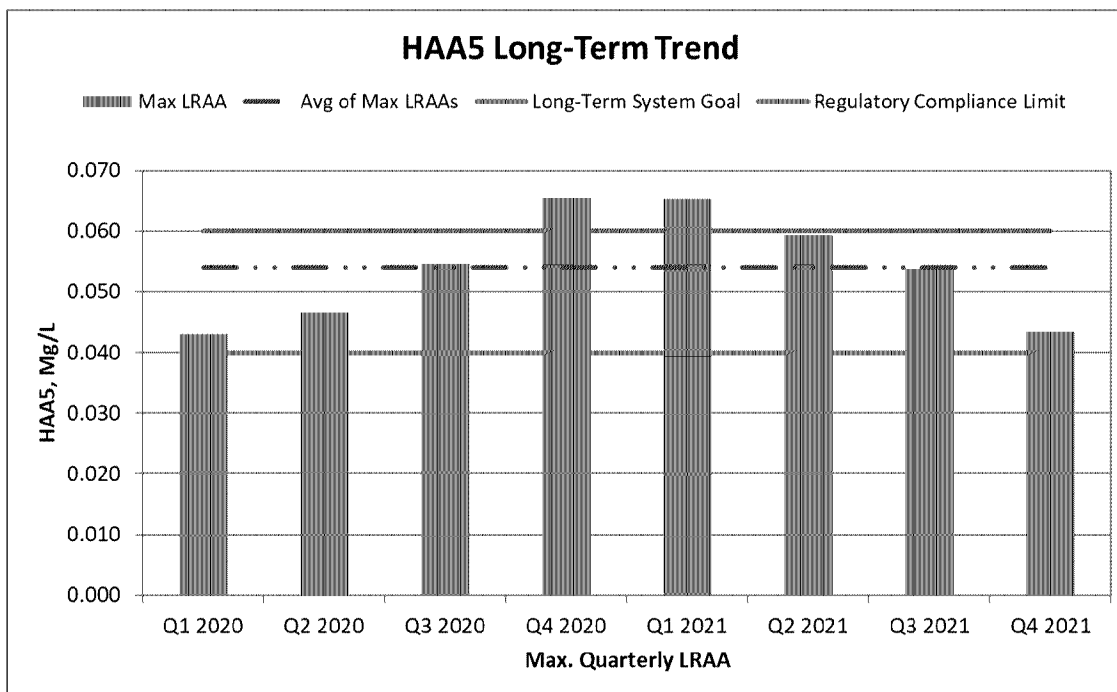


Figure 15. HAA5 Long-Term Trend

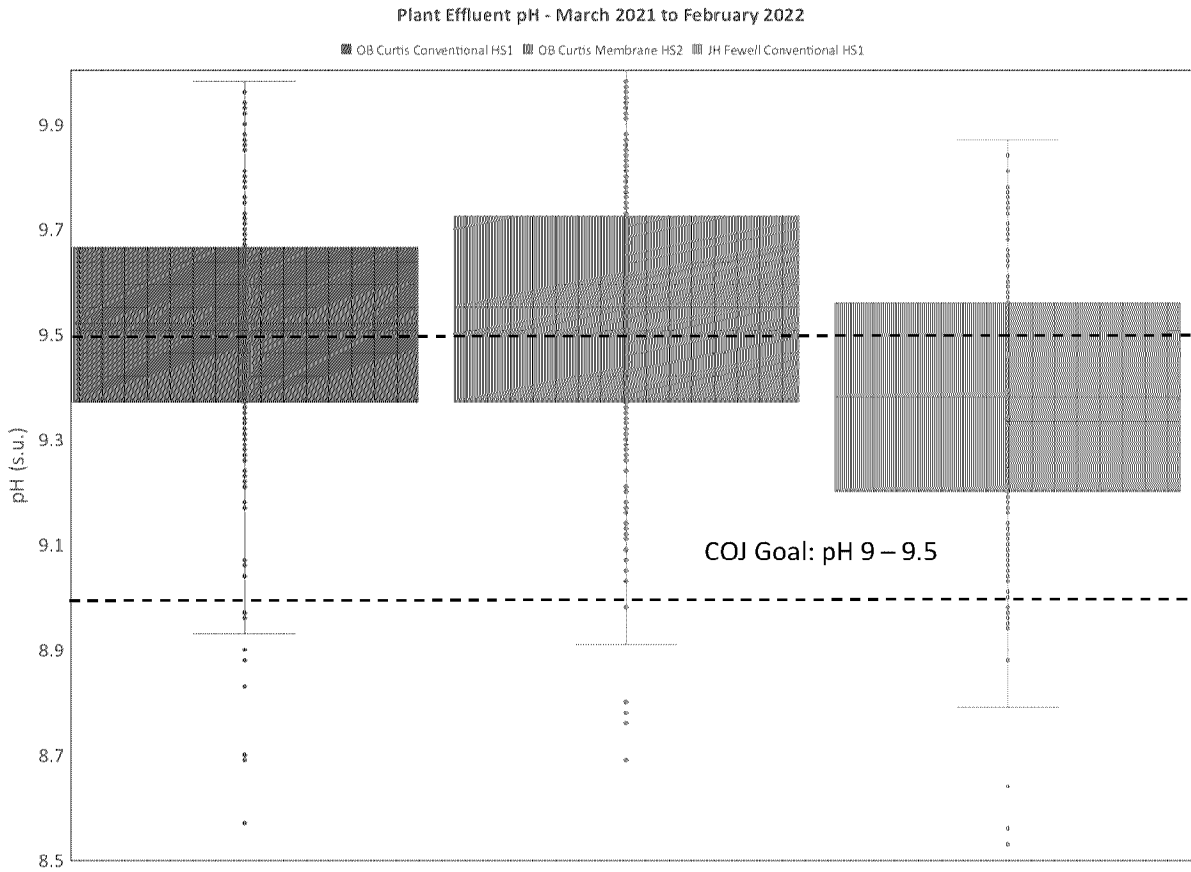
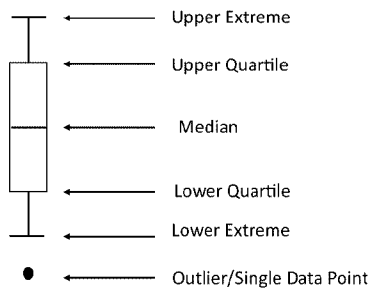


Figure 16. Plant Effluent pH Values from March 2021 through February 2022

Key to Reading Box and Whisker Plot Above:



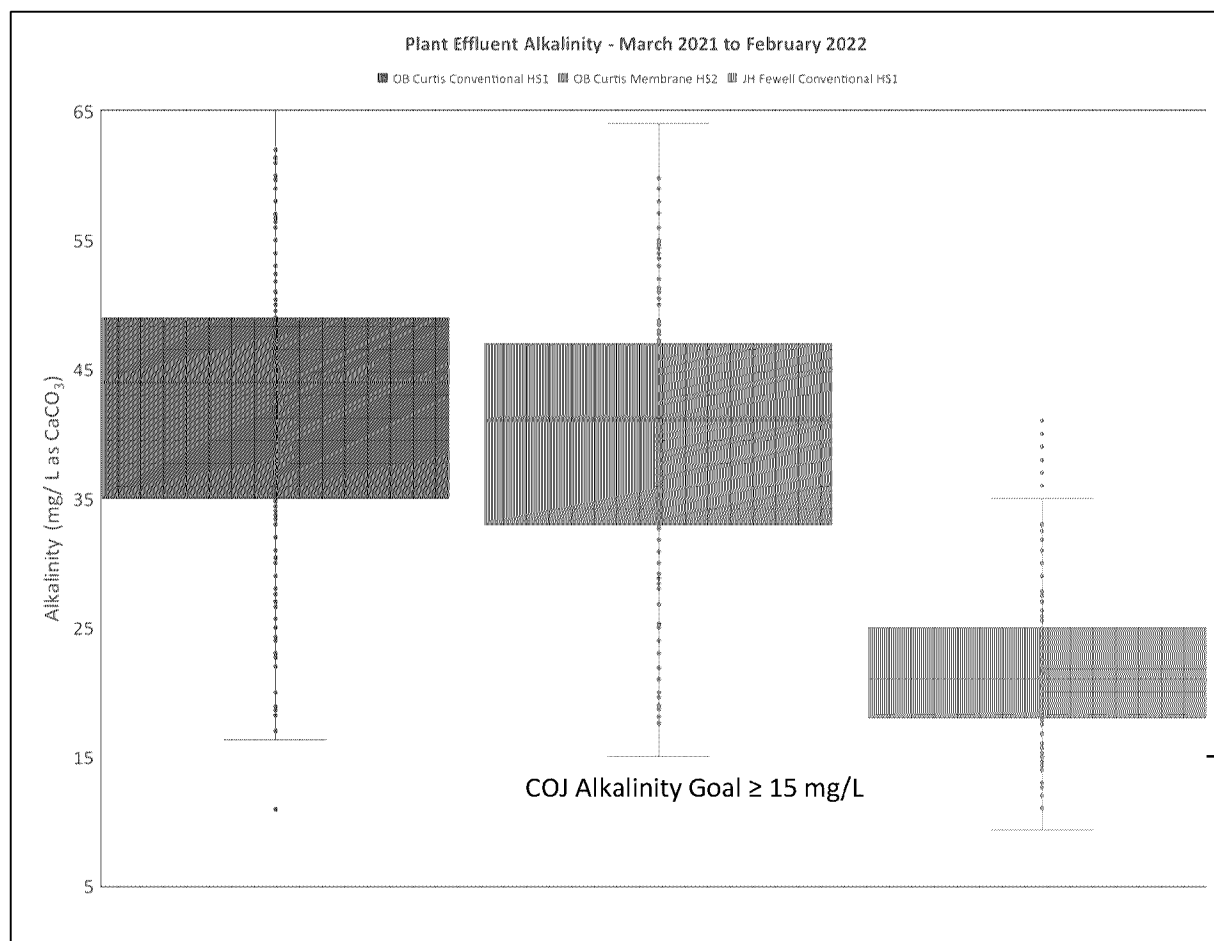
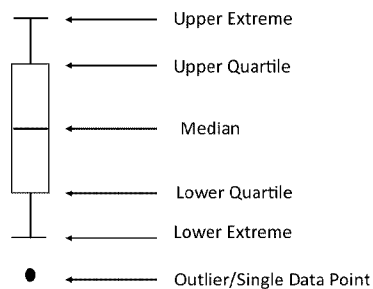


Figure 17. Plant Effluent Alkalinity Values from March 2021 through February 2022

Key to Reading Box and Whisker Plot Above:



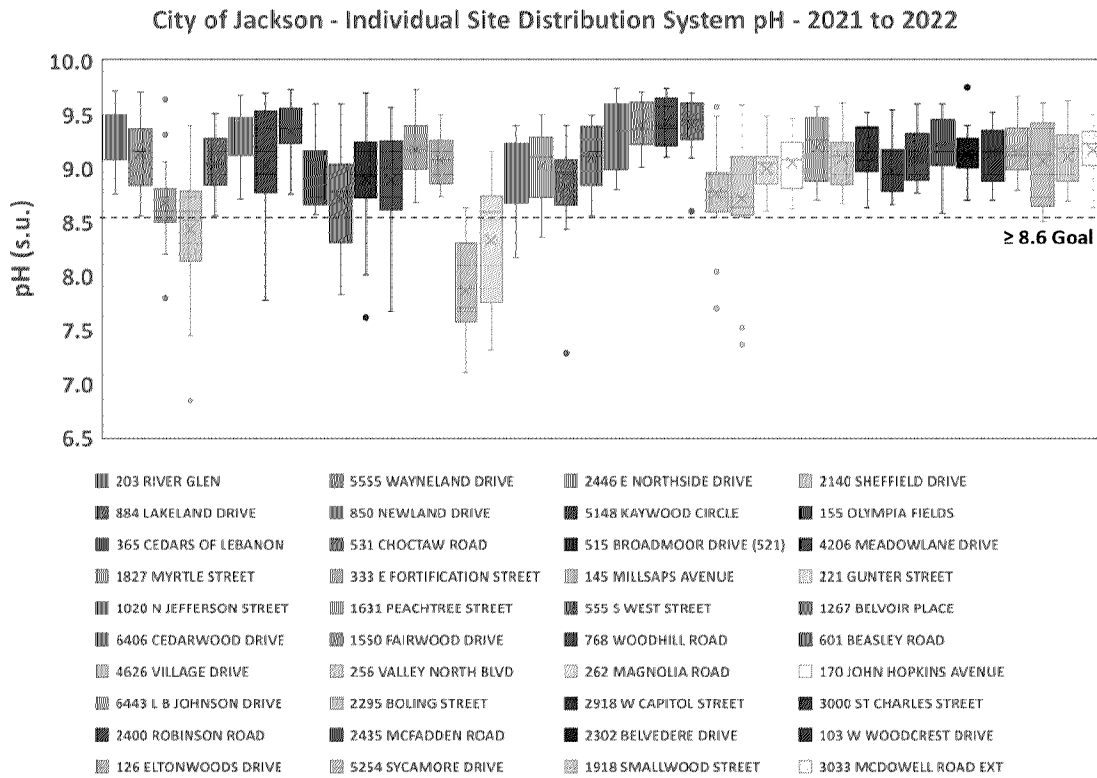
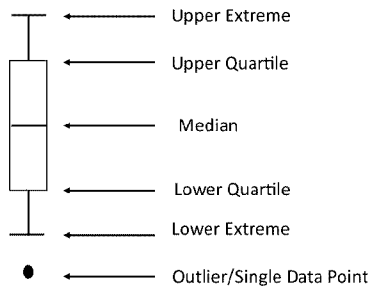


Figure 18. Distribution System pH Values from 2021 through 2022

Key to Reading Box and Whisker Plot Above:



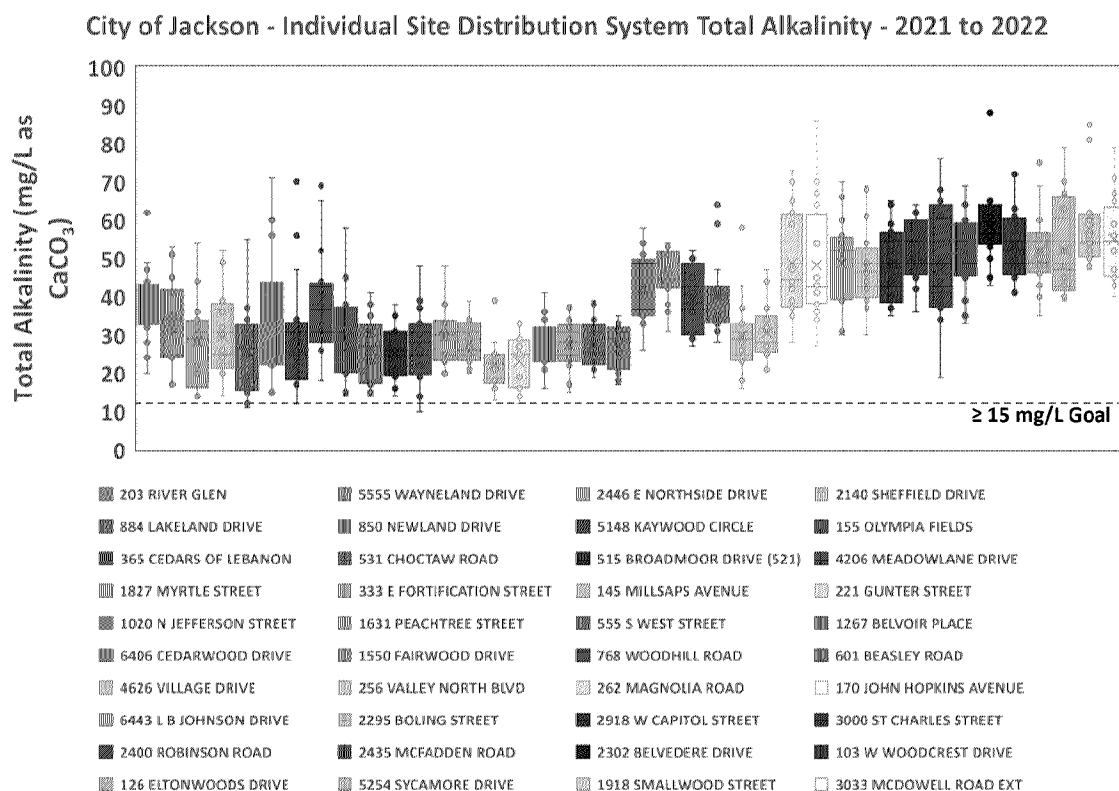
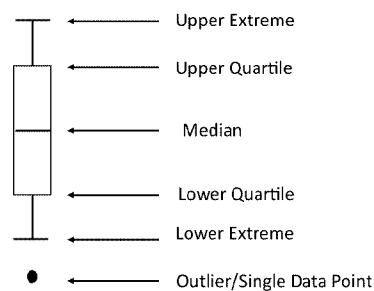


Figure 19. Distribution System Alkalinity Values from 2021 through 2022

Key to Reading Box and Whisker Plot Above:



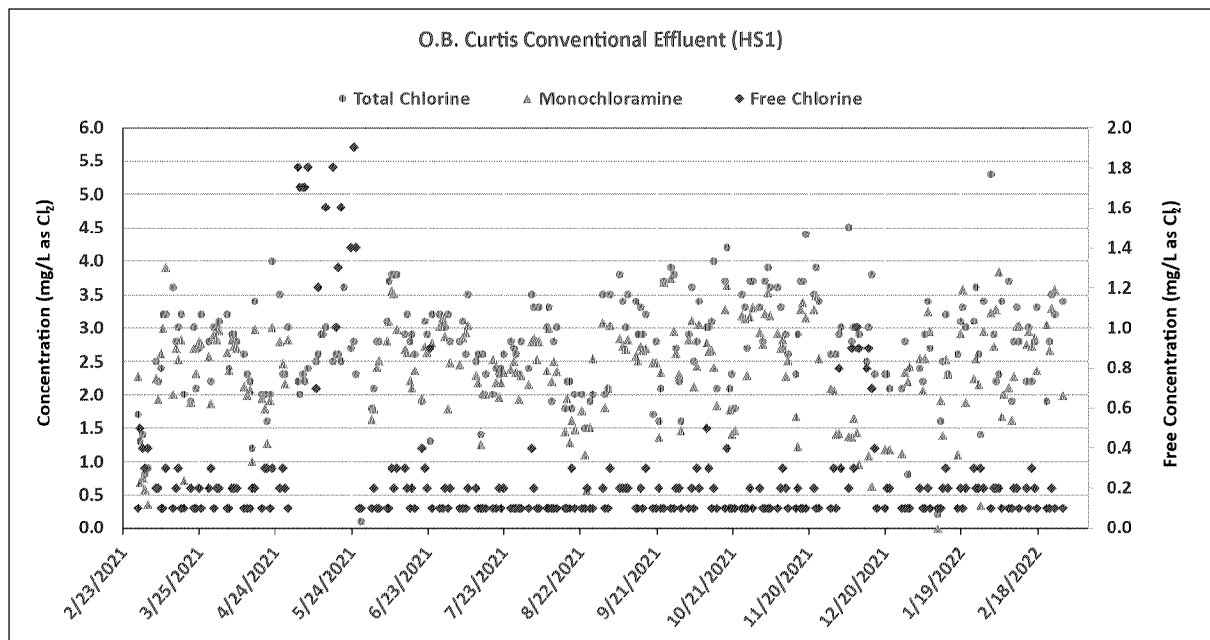


Figure 20. Curtis Plant Free, Total, and Monochloramine Residual Trend at the Entry Point

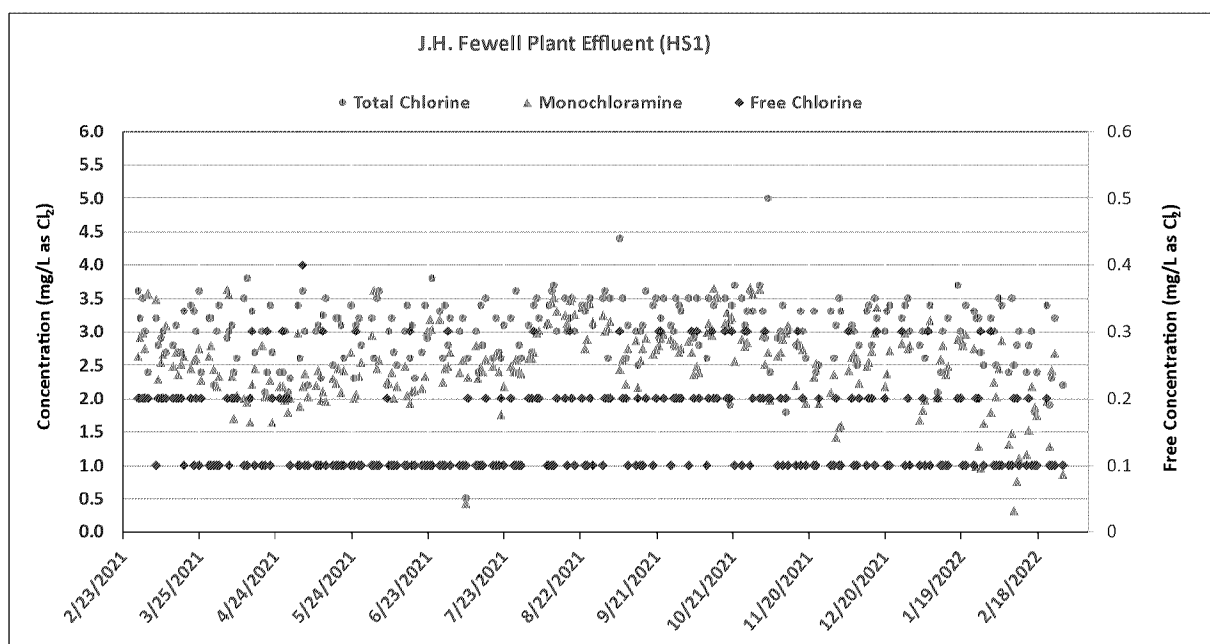


Figure 21. Fewell Plant Free, Total, and Monochloramine Residual Trend at the Entry Point

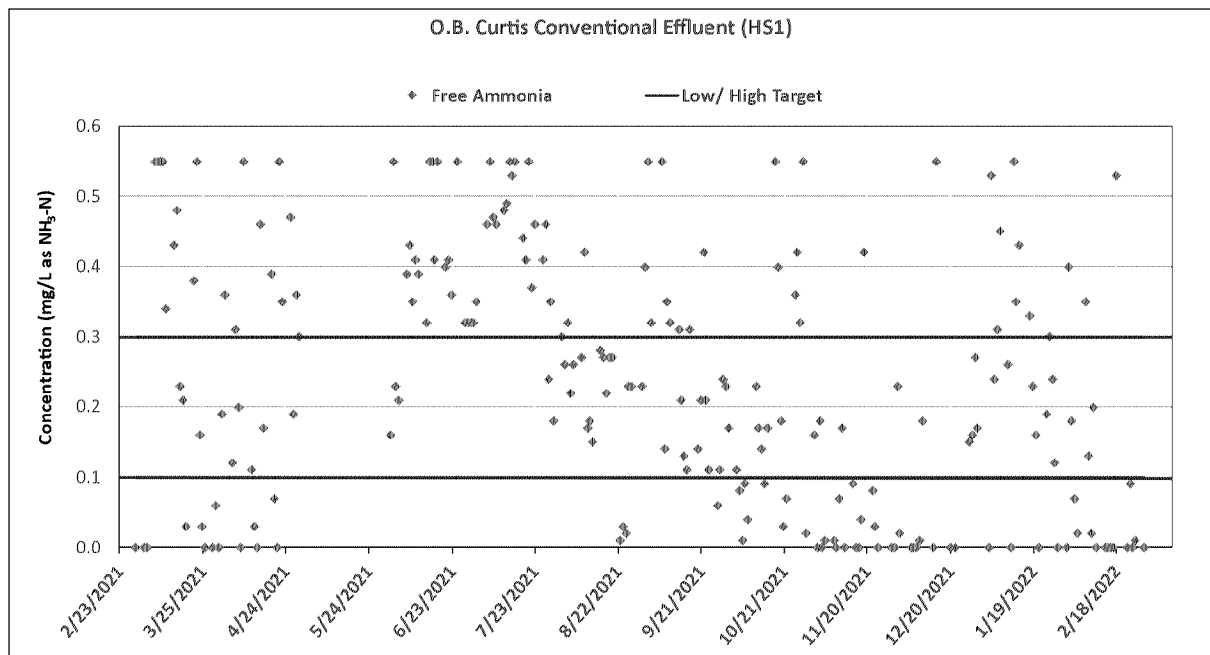


Figure 22. Curtis Plant Free Ammonia Residual Trend at the Entry Point

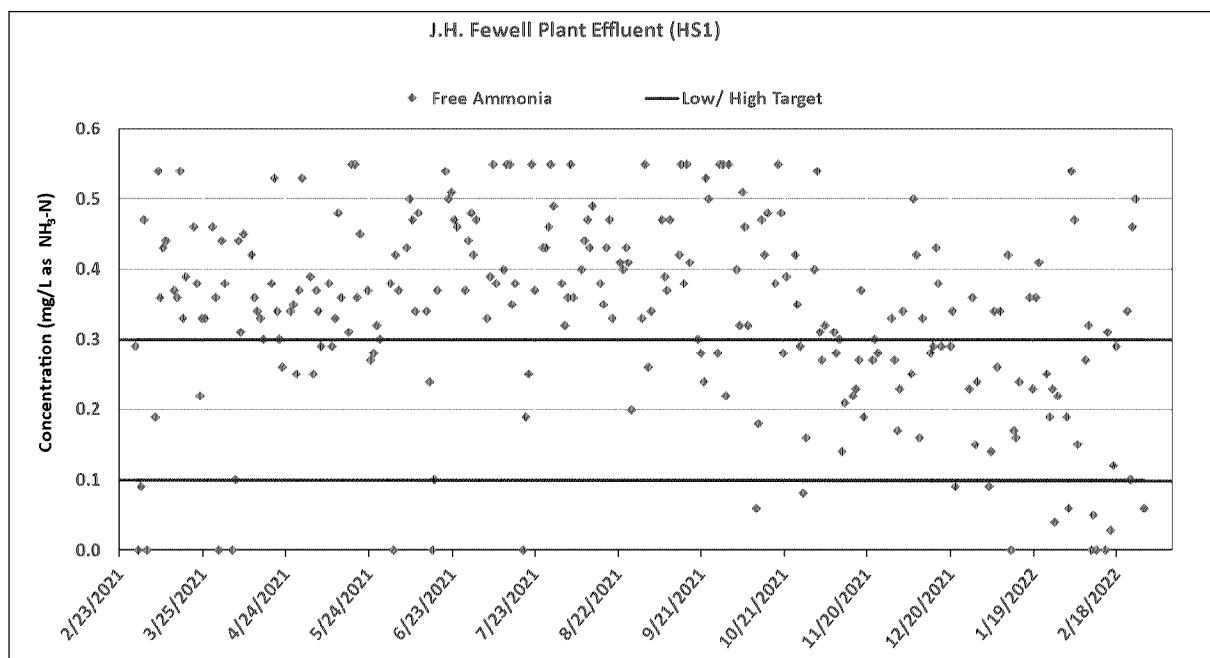


Figure 23. Fewell Plant Free Ammonia Residual Trend at the Entry Point